Theoretical Model on the Effect of Leadership Style and Knowledge Management toward Successful Collaborative Design

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Abstract - **Collaborative design process in a construction projects involves designers whom have various expertise. The process requires integrated design object and design team. Knowledge management plays an important role in supporting the process. Leadership style is required to mediate the implementation of knowledge management in improving the performance of team to achieve the best design. This study aims to develop a theoretical model through literature review and surveys. Literature of leadership style, knowledge management, and collaborative design are comprehensively reviewed. The scope of literature review mainly discussing the content background of the problem, methodology and research results. Literature review is used to build the theoretical model. Confirmatory study is applied by using *Structural Equation Modeling* (SEM). The result of this study is a theoretical model on the effect of leadership style and knowledge management toward successful collaborative design.**

Keywords: Leadership Style, Collaborative design, Construction Project Management

I. INTRODUCTION

The development need of product innovation and technology in construction industry are some reasons that caused design more complicated [1, 2]. The design process requires technologies, methods, concepts and innovations to achieve the optimal design [2, 3]. The design process needs knowledge and expertise from various disciplines of participants [4]. The participants need to integrate their knowledge and expertise in producing design to achieve the best design [5]. "Reference [6]" stated that the best design would be difficult to achieve because of the problem in integration participants and design objects. Based on the results of literature review, one approach that can be applied in the design process to achieve the best design is the collaborative design [5, 7].

There are some approaches used in collaborative design research in achieving the success of collaborative design [1]. These factors are physical factor, technical factor and social factor. Physical factor is a factor related to media facilitates the collaborative process participants [8], technical factor is a factor related to knowledge management and used to manage data and information in collaborative design [9] and social factor related to the participants and team work in collaborative design [10, 11].

Knowledge management required to solve one of the problems that arise in collaborative design process [9]. The problem that happens is difficult to achieve understanding among participants involved, which can lead to conflict and difficulties in negotiating and decision-making [10, 12]. This difficulty is caused the lack understanding of participants about design development process, thus knowledge management is required [9].

The process of integration in collaborative design requires leadership when a design process is conducted by participants whom have various background and expertise [13]. Collaboration in this case was conducted in collaboration entire team design includes a collaboration of groups of different scientific incorporated in the design team, either from the individual design incorporated in the design engineering consulting company [4, 14]. Leadership style can develops structure of the team, especially when teams collaborate through media that support collaborative design process [15].

Leadership styles and media richness on task and collaboration unification will affect the performance of the team in decision-making [10, 14]. Decision making requires techniques, methods, tools and knowledge management to achieve the best result in collaboration [3]. Leadership and knowledge management is an important factor for successful achievement of the goals of collaborative design [1, 15]. Negotiation also plays important role to achieve understanding of various participants in collaborative design process [16].

A framework that shows the relationship of leadership style, knowledge management and collaborative design stated in reference by [1]. By adopting the framework of the model, this research builds a theoretical model on the effect of leadership style and knowledge management toward successful collaborative design. Formulation of the problem in this research is how to builds the theoretical model and confirms the model by using Structural Equation Modeling (SEM) with empirical data from survey results.

II. LITERATURE REVIEW

The literature review is applied by accumulating literature in the form of the results of scientific research in the disciplines of leadership style, knowledge management and collaborative design.

A. Leadership Style

Leadership styles research related to their influence on a team to achieve the stated goals is discuss by Huang et al. [10], based on research conducted found that the union leadership style can affect the formation of a team that encourages collaboration team. Collaboration process in team work influence by the richness of the media caused by the object [10]. The lower level of the media both transactional and transformational leadership style will be even greater role in facilitating collaboration and unification of the team and it was the other way, if the media are being used increasingly to support the role of leadership behavior will decrease [17].

"Reference [10]" found that transactional leadership behaviors improve team unification, being more transformational leadership behaviors improve team collaboration. This research also proves that collaboration gives a positive influence on the team and collaboration accelerates the unification of task completion time.

The right leadership will lead to the individual and the group will learn to adapt the system. Each element of the team will continue adapt to internal and external changes that occur [18], so that the integration of dimensional changes will contribute the success of leadership. Leadership style is a means to sustain the change and that communication should occur more often and more effectively, and make the employee involved [10]. The effectiveness of communication includes the two-way communication between the members and leaders so that members of the organization can understand and work effectively to accomplish a change in a new and better. The success of the changes affected the strong relationship between the three components: people, processes and technology [18].

The success of a project initiates by collaborative design process between all the participants in influenced by the leadership team within the team [18]. Project managers are required to have a leadership that is able to create effective team work in achieving successful achievement of project implementation on schedule as planned [17]. Appropriate leadership model is represented by the concept of transactional leadership and transformational leadership concept. "Reference [17]" concluded that the model of leadership can affect team work are contingent reward, management by exception-active management by exception- and passive, idealized attributes, inspirational motivation, intellectual stimulation and individualized consideration. The relationship transactional and transformational leadership with team work affect the performance of a project is worth 57.7%. This research also found that the effective cooperation is influence by factor of communication, collaboration and team work in achieving project time performance [18].

The leadership is divided into two types: transactional leadership and transformational leadership. Team work is measured based on team communication, team collaboration and team work [17]. The value of the project's performance in this study measured the performance schedule, cost performance, quality performance and stakeholder satisfaction. From the analysis carried out by the researchers, it was found that the relationship between team members increases with an increase in the level of leadership [18] to obtain the increasing success of the project, the project manager who adopts transactional and transformational leadership should improve team collaboration, team communication and team work. The success of project with high complexity can be generated through a strong team communication, collaboration and team work [17].

B. Knowledge Management

Knowledge management is one of the factors that support successful of collaborative design [1]. Knowledge management is a systematic approach that considers the overall utilization of the organizational knowledge base combined with personal skills, competencies, ideas, innovations and ideas to make or create the organization more effective and efficient. "Reference [19]" indicated that collaboration in design process will work effectively if structured collaborative process undertaken in the sharing of information. Collaborative design requires the skills of management of dynamic organizational design with the use of technology to support design process [9].

Knowledge management plays an important role in supporting the success of collaborative design [19]. Knowledge management can help the process of problem solving, because with knowledge management no longer needed a long time to provide expert [1]. The role of knowledge management during the design process is important because many participants are involved in design process have different backgrounds [2]. The differences backgrounds caused a problem of lack understanding between participants, so knowledge management can support the success of collaborative design [1].

"Reference [9]" describes the limited knowledge about the use of communication media vary in design collaboration process. This study aims to develop a clearer idea of the collaborative needs of architects using computer mediation. This study also tried to develop a coding scheme to help investigate the possible effects on the design of verbal communication. "Reference [19]" states that knowledge management to manage data and information in collaborative design. Knowledge management is needed to resolve difficulties that occur in design collaboration process. This difficulty is caused due to lack of participants or lack understanding the design

development process. To overcome this problem takes the role of knowledge management in collaborative design

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C. Collaborative Design

The main purpose of collaborative design is facilitate the integration of design object and design team to produce the best design [7, 20]. Collaborative design is an activity that is the participation of multiple participants to share information and organize the work and design resources [21, 23]. Collaborative design is a process in construction projects contained in the project life cycle that is at the planning process and completed by groups who have different expertise with the aim of a design concept that a complex system [7, 24]. Collaborative design is a design process that involves agreement among all participants involved to provide brainstorming skills and their ability to accomplish goals of a project as a whole, the goals and expectations that have been declared by the user, owner or community who have an interest in a project [16, 25].

A few of collaborative design research found the nature of collaboration and its implications in the form of a tool to support the process work in a collaborative design. From reference [21] showed that collaboration is a full commitment to a common mission, whose authority based structure within the organization, it takes a high level of trust among members in a collaborative design. The study also concluded that there are three types of collaboration in collaborative design are mutual collaboration, an exclusive collaboration and dictator collaboration. According to [4] the design is an activity that includes a variety of domain knowledge both of engineering design, architectural design and software design problems tend to be large and complex. The characteristic of collaborative design work is interdependence in the design and integration of multi-perspective [26]. The results of this study stated that the interdependence of work, work organization and modular design, informal communication and procedures and awareness. This study also discusses the integration of multi-perception include the unification of opinion, view point unification and formation of joint criteria.

"Reference [5]" discuss technical and social framework for the collaboration where the research using modeling and conceptual models are built aims to bridge the technical and social approaches to facilitate the achievement of successful collaborative design. The research found in the model formulation integrating technical and social aspects to support successful collaboration.

The developing of knowledge management model that can support the achievement of success in collaborative design process discuss in research by reference [1]. There are two aspects can support the achievement of success in collaborative design. Aspects of knowledge management through the media factor considerations, facilities and communications and team work aspects to consider formation [19]. Aspects of leadership styles and behaviors of participants are two main aspects to consider in the achievement of collaborative design and selection criteria for adaptive and collaborative [1]. The understanding aspects achieving the best design and integration is a major aspect to consider in the selection criteria for the success of collaborative design for the success of the concept of sustainable development [21, 22].

III. RESEARCH METHODOLOGY

This paper is used to formulate and to confirm theoretical model of research through the application Structural Equation Modeling (SEM). Survey method used in this study to measure the perceptions of respondents about the research object.

The literature study obtained the conceptual framework that is used in the study as shown in Figure.1:

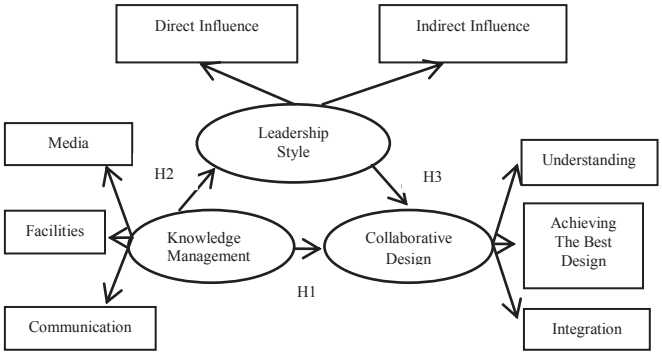

Fig. 1 Conceptual model adopting [1], [23], [27], [9], [5], [7], [28], [10],[29]

The hypothesis of this study can be described as follows:

1. Variable of knowledge management influence collaborative design.
2. Variable of knowledge management influence leadership style
3. Variable of leadership style influence collaborative design.

IV. RESULTS AND ANALYSIS

The results and analysis of the models are developed by using the SEM from results of data survey obtained from 79 respondents in Semarang, Solo and Yogyakarta as shown in figure 2:

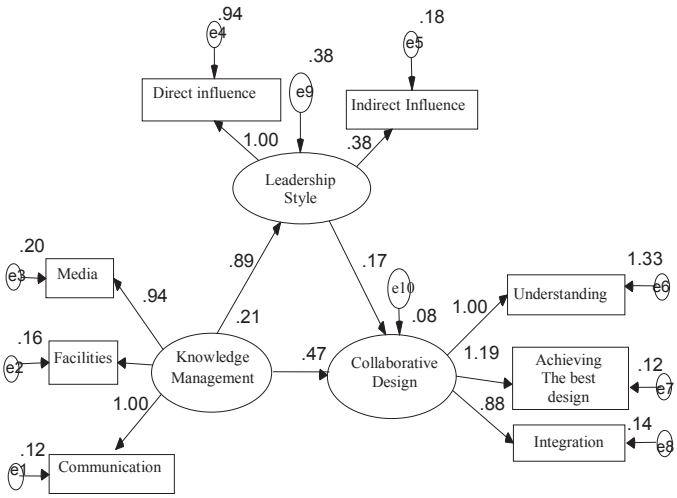

Fig. 2 Results of SEM analysis

The results that indicates goodness of fit of the model as shown in Table 1:

TABLE I
GOODNESS OF FIT INDICATOR

Goodness of fit index	The results of the conceptual model	*Standard value*	Evaluation of the model
Chi-Square	12.002		fit
RMSEA	0.000	≤0.08	fit
GFI	0.966	≥0.90	fit
AGFI	0.927	≥0.90	fit
RMR	0.038	<0.05	fit
NFI	0.930	≥0.90	fit
CFI	1	≥0,90	fit

Confirmatory factor analysis on the measurement conceptual model of leadership style supporting the achievement success of collaborative design indicates that the conceptual model is acceptable, in addition to the loading factor between each variable also positive.

The Value of the loading factor between factors knowledge management with collaborative design is 0.47, the first hypothesis (H1) is accepted, the knowledge management factor positive influence on collaborative design factor. The value of loading factor between leadership style factors with leadership style is 0.89 so the second hypothesis (H2) is accepted.

The leadership style factor positive effect on factors of collaborative design, for the third hypothesis (H3) is also accepted with positive value is 0.17.

III. CONCLUSION

The factor of leadership style has positive influence on the success of collaborative design, while the knowledge management gives positive effect on leadership style and the leadership style also has positive effect on the success of collaborative design.

ACKNOWLEDGMENT

Authors appreciate recognitions and awards in forms of research grant from *Riset Unggulan Perguruan Tinggi tahun 2014*, which are entitled "Pengembangan Konfigurasi Spasial dan Nilai Ekonomi Urban Heritage yang Adaptif dan Kolaboratif". Authors would like to thank to Institut Teknologi Sepuluh Nopember (ITS) for funding the research.

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